NASA SBIR/STTR Technologies

T3.01-9840 - Power Generating Coverings and Casings

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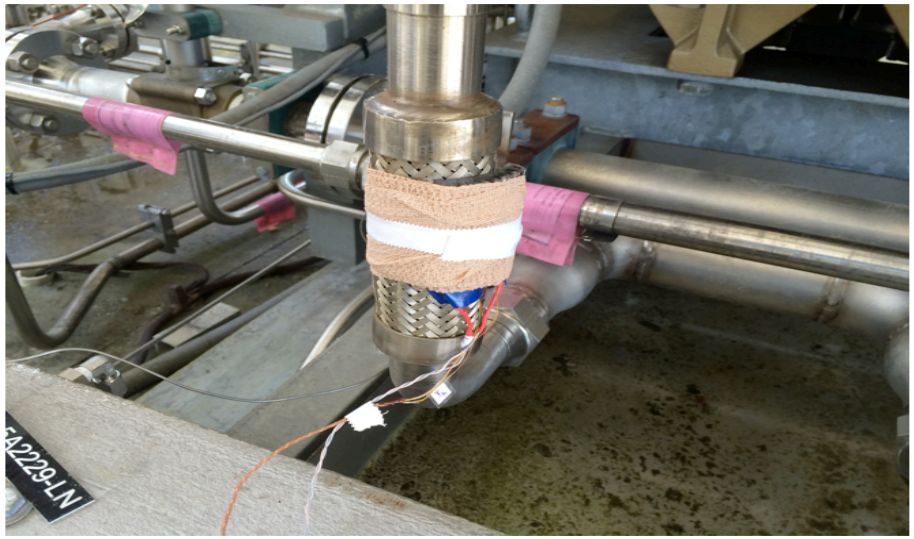
Identification and Significance of Innovation

Ceramics, like BiTe, are the only thermoelectric materials used to harvest waste energy. They are heavy, rigid, and only applicable to smooth geometries such as flat plates or cylinders. Ceramics lack the ability to harvest vibrational energy into electrical power. Power Felt, being a fabric-like material, conforms to any object that produces heat. Ceramics have a greater efficiency in power generation, but Power Felt flexibility will have a much greater area of contact, more than makes up for its lower power generating efficiency. During Phase I, the ability to generate power from Power Felt increased by ten times, added the ability to generate power from vibrational energy, and determined that the total power generated was greater than the sum of the individual components. Although not complete, the Phase I program developed techniques that can be combined to develop a manufacturing process that will produce Power Felt at a lower cost and more consistently.



Estimated TRL at beginning and end of contract: (Begin: 4 End: 6)

Technical Objectives and Work Plan

The primary objective in Phase I was to demonstrate the scientific, technical, commercial merit, and feasibility of an innovative fabric covering that can harvest power from highly energetic environments.

The specific technical objectives of Phase I were:
* Demonstrate printing as an approach to the manufacture of appliques and plaques. This will demonstrate the ability to print test pieces with an internal interconnect system that allows for ease of use and single-unit applications.
* Demonstrate combined thermal and kinetic energy scavenging capabilities from these test pieces. The test plaques will be robust to puncture, scuffing, most solvents or scratching, and will provide power regardless of the direction of heat flow (hot to cold or cold to hot) or the form of mechanical energy encountered.
* Manufacture a 1-m2 fabric after successful demonstration of the small pieces. The printed multi-module pieces will have a specific area density of approximately 50 grams/m2 for Phase I. Testing this fabric will show that the overall power output will scale with area.
* Develop custom circuitry for eventual integration into the PowerFelt fabric that does not diminish the advantages inherent with the material. We will design this system for the collection, storage, and distribution of the harvested energy.

NASA Applications

NASA can exploit this technology wherever thermal gradients and vibrations are present. Two potential applications at NASA Centers for PowerFelt are providing power to remote sensors around the facility and to supplement/eliminate batteries in experimental apparatuses at the test stands. Launch and space applications include supplemental/backup power for instrument and life support on manned, non-manned, and planetary exploration vehicles; satellites; instrument and life support on ISS.

Non-NASA Applications

Applications for DoD include minimizing the battery weight for ground troops; missile; submarines; surface ships; unmanned aerial vehicles. Civilian market applications are similar to those for NASA and DOD, that is to eliminate or reduce the need for batteries and incorporation of PowerFelt into textiles; cell phone holsters; and power generation during emergencies.

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